

TASK #: 07-042
QUARTERLY TECHNICAL PROGRESS REVIEW

TASK # & TITLE:	07-042 SDRAMs and SRAMs
QUARTER:	4Q FY07
COORDINATING CENTER:	GSFC
PARTICIPATING CENTER/S:	
PROGRAM AREA:	NEPP
TASK MANAGER:	Dr. Ray Ladbury/GSFC
CUSTOMER:	NEPP

TASK DESCRIPTION

SDRAMs and SRAMs

Mass storage technologies are commonly used in space systems for storage of telemetry prior to shipment to the ground. Two architectures are being considered: solid-state (volatile and non-volatile) and hard disk. This effort seeks to evaluate new devices of potential interest for high-reliability space applications. This includes SDRAM and SRAM devices and leverage off of LRO's hard drive efforts.

SRAM devices are of interest for recent spate of SEL data (very sensitive). This will be further investigated.

GOALS/OBJECTIVES

SDRAMs and SRAMs

This work will develop test hardware and techniques for characterizing state of the art COTS memory devices. In addition, the effects of device scaling on various error modes will be assessed and trends noted. Of particular concern are very disruptive error/failure modes, such as single-event latchup (SEL) and single-event functional interrupt.

DELIVERABLES

SDRAMs and SRAMs

FY06 Deliverables	Quarter Due	Quarter Completed	Notes (changes to deliverable list or why not on schedule)
Proton testing of Samsung Samsung K4T1G03XXX and Elpida EDE1104ABSE-5C-E Gbit DDR2 SDRAM	Q3/07	Q3/07	
Heavy Ion Testing of Samsung K4T1G03XXX and Elpida EDE1104ABSE-5C-E Gbit DDR2 SDRAM	Q4/07	Q4/07	
TID test plan for Samsung K4T1G03XXX and Elpida EDE1104ABSE-5C-E Gbit DDR2 SDRAM	Q4/07	Q4/07	
Proton test plan for Micron MT47H128M8HQ-3:E DDR2 SDRAM	Q4/07	Q4/07	
Other tests as samples become available			

SCHEDULE

SDRAMs and SRAMs

Mass Memory Storage-Radiation	2006			2007								
	O	N	D	J	F	M	A	M	J	J	A	S
Parts Procurement												
SEE Test Development												
TID Test Development												
Test Reports									◆			◆

MAJOR ACCOMPLISHMENTS THIS QUARTER

SDRAMs and SRAMs

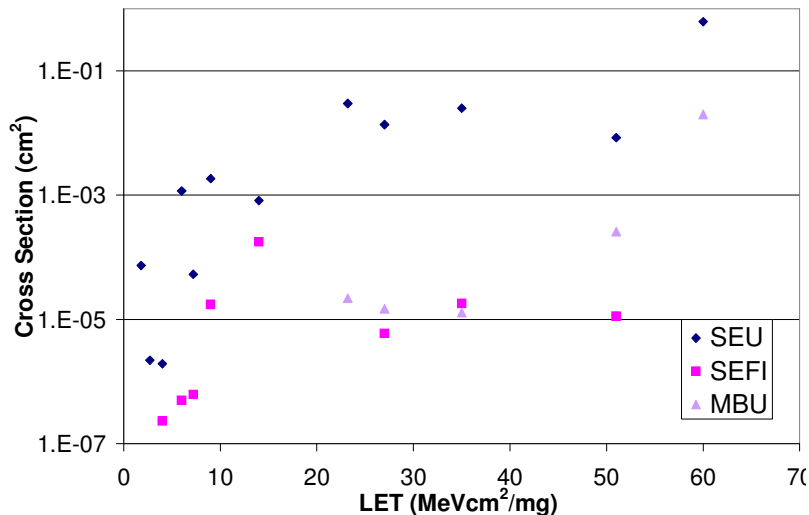
- Completed SEE testing of Samsung K4T1G03XXX and Elpida EDE1104ABSE-5C-E Gbit DDR2 SDRAM
 - **Data for SEU, MBU, SEFIs and SEL summarized in report**
- Preparations ongoing for TID test at GSFC in Nov. 2007
- Samples obtained from Micron
- Preparations ongoing for proton test at IUCF, Oct. 2007
- Preparations begun for heavy-ion test at TAMU, Oct. 2007
- Trying to obtain more test samples from Samsung and Elpida

TECHNICAL HIGHLIGHTS

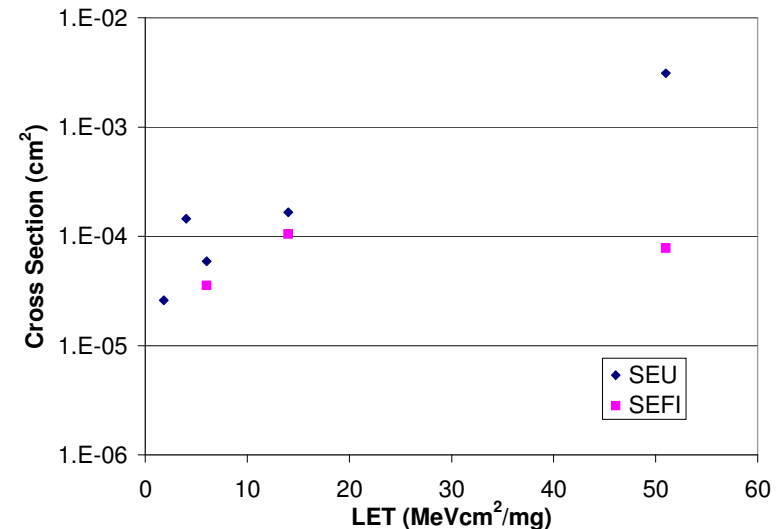
SDRAMs and SRAMs

- Heavy-ion testing on 1 Gbit DDR2 SDRAM from Samsung shows favorable SEL and SEFI characteristics-no SEL.
 - SEU σ vs. LET curve is not RPP at low LET
- Elpida data mostly favorable--SEL @85 °C $14 < \text{LET} < 50 \text{ MeVcm}^2/\text{mg}$
- SEUs and SEFIs seen at the lowest LET ($1.8 \text{ MeVcm}^2/\text{mg}$)
- SEUs and SEFIs also seen with protons (98 and 198 MeV)

Samsung Cross Sections vs. LET



Elpida Cross Sections vs. LET



PLANS FOR NEXT QUARTER

SDRAMs and SRAMs

- SEE testing of Micron MT47H128M8HQ-3:E DDR2 SDRAM at TAMU
- Proton testing of Micron MT47H128M8HQ-3:E DDR2 SDRAM at IUCF
- TID testing of Micron MT47H128M8HQ-3:E, Samsung K4T1G03XXX and Elpida EDE1104ABSE-5C-E DDR2 SDRAMs @GSFC
- Other devices: Pending Availability
- Submissions to NSREC and SEE Symposium

Partnering

SDRAMs and SRAMs

- Memories supplied by Samsung, Elpida and Micron for TID and SEE assessment.
- Discussions under way with Infineon and others.

PROBLEMS AND CONCERNS

SDRAMs and SRAMs

- Thinning of SDRAMs has a poor yield. Elpida parts stopped working about 1 month after thinning—probably due to stress on solder balls
- TID testing necessitated redesign of the daughter board so the voltage regulator could be removed
- Timing is still difficult and trial and error—varies from part to part—and represents a significant level of effort for VHDL engineer.